How Septic Systems Work

Goals: To have students understand how a septic system works. To help students realize how septic systems, if improperly cared for or placed in an unsuitable location can pollute groundwater.

Subjects: Science, Health, Home Economics

DPI Objectives: SC: A1-A3, D1, D2

EH: A1-A3, B1, B3, B4, C1, C3, C4

SS: A1, B1-B3, C1, C3

Grades: 6-9

Materials:

- 6 Steps to a Successful Septic Tank System overhead*
- The Septic Tank at Work overhead*
- How Septic Systems Work activity sheet
- for each group of 2-4 students:
  - one small (6-8 oz.) glass jar or beaker
  - one large (12 oz.) glass jar or beaker
  - sand
  - paper towel
  - potting soil
  - green food coloring
  - flexible straws
  - small pieces of white paper (e.g. holes from paper punch)

* masters provided

Background: Many rural homes use septic tank systems for disposal of wastewater from sinks, bathtubs and toilets. There are two parts to a septic system: a settling/storage container (septic tank) and a filtering area (soil absorption or leaching field). Both parts of this system are essential for proper wastewater disposal.

The main purpose of the settling tank is to protect the soil absorption field. Inside the settling tank, solids settle and form a sludge layer on the bottom and floating materials accumulate in a scum layer at the water surface. Clarified wastewater leaves the settling tank through a submerged outlet. The scum and sludge are left behind. This is important because scum and sludge can clog soil pores and cause the leach field to fail.

Bacteria in the septic tank helps to break down the scum and sludge that remains. Decomposition of these layers is slow, so scum and sludge gradually build up and must be removed periodically. Using kitchen garbage disposals increases the amount of solids in wastewater and speeds up sludge accumulation. (Composting vegetable matter instead of putting it down the garbage disposal keeps extra solids out of septic systems and also provides good fertilizer for flowerbeds and gardens.)

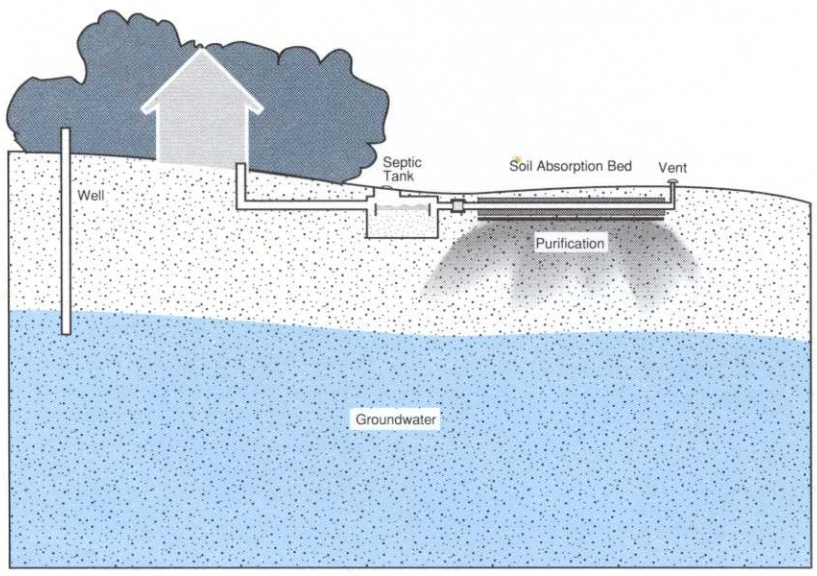
The soil absorption or leaching field does two things. It slowly disposes of wastewater below the surface of the ground, and it filters out harmful bacteria and many chemical contaminants before they reach groundwater.

Watertight pipes transport wastewater from the septic tank to the absorption field. In the absorption field, the water is divided among several trenches. Perforated, rigid plastic pipe or agricultural drain tile distributes the water throughout the trenches. A gravel bed below the distribution pipes temporarily stores the wastewater until it is absorbed by soil surrounding the trench.

Septic systems can pollute groundwater if the capacity of the surrounding soil to filter the wastewater is exceeded or if the underlying soils are very permeable, allowing contaminants to move rapidly to the water table before filtering is complete. Groundwater may also become contaminated if chemicals that are not decomposed by soil bacteria are dumped down sinks or toilets.

Adequate spacing of homes and proper planning, design, construction and maintenance of septic systems is the best insurance against groundwater contamination by household wastewater. Planners must consider the location of buildings, water supplies and soil characteristics. They must also decide how large a septic tank and absorption field is needed.

Proper maintenance of the system includes periodic pumping of sludge from the septic tank. Depending on the size of the tank and the number of persons in the household, cleaning may be needed as often as every two years or as seldom as every ten years, but tanks should be checked yearly.



Procedure:

A) Explanation.

1. Using the overheads, briefly discuss where wastewater goes in rural areas. Explain how a septic system works.

B) Investigation.

1. Work in small groups. Prepare a "wastewater" sample—water, sand, bits of paper and 2-3 drops of green food coloring.

2. Construct a model septic tank system: